UNIVERSITY OF MINNESOTA | EXTENSION

TOURISM CENTER

Mainstreaming Motel Optimization: Guest Survey Results

Authored by Xinyi Qian, Ph.D., Katrina Nygaard, and Carl W. Samuelson, C.E.M.

Mainstreaming Motel Optimization: Guest Survey Results

March 6, 2015

Authored by Xinyi Qian, Ph.D., Katrina Nygaard, University of Minnesota Tourism Center, and Carl W. Samuelson, C.E.M., Michaels Energy

Editor:
Elyse Paxton

Report Reviewers:
Nancy Kelly
Alexis Troschinetz

Partners/Sponsors:
This project was supported in whole by a grant from the Minnesota Department of Commerce, Division of Energy Resources, through the Conservation Applied Research and Development (CARD) program, which is funded by Minnesota ratepayers.

Michaels Energy contracted the University of Minnesota Tourism Center to conduct the research documented in this report. The research is part of a larger CARD grant to document energy efficiency opportunities in the hotel sector. The results of the full project, including those shared in this report, will be available in the future by the Department of Commerce.

The University of Minnesota Tourism Center is a collaboration of University of Minnesota Extension and the College of Food, Agricultural and Natural Resource Sciences.

Table of Contents

List of Figures

List of Tables

LITERATURE REVIEW

The existing literature on hotel guest experience is abundant. Studies range from determining items of primary concern to guests, to the importance of sustainability and "going green" in the lodging sector, to survey design methods. These studies have facilitated the understanding of sustainable lodging and guest comfort, as well as guided survey design for the Motel Optimization Project. The literature review begins with an outline of relevant definitions and an overview of the theoretical framework. Next, it outlines important findings from the existing literature, as well as provides two case studies as guiding examples for our research. An annotated bibliography is included in Appendix A of this report.

CONCEPTS AND DEFINITIONS

The study of guest behavior within the lodging sector can be broken into three main categories based on the time the guest is surveyed. These categories include pre-stay expectations, during-stay comfort, and post-stay satisfaction.

Pre-stay expectations

Guest expectations regarding service quality and anticipated experience are derived from a variety of sources: room price, past experiences, and knowledge gained from others and the media (Barsky, 1992). These perceptions can be measured before or after a stay by conducting surveys about guest expectations and whether or not they were met.

During-stay comfort

For hoteliers, comfort during the stay is a very important part of the guest experience (Barsky, 1992; Min, Min, & Chung, 2002). Comfort, which can also be viewed as meeting expectations, is the most important factor in determining overall satisfaction (Barsky, 1992). However, unlike pre-stay expectations or post-stay satisfaction, guest comfort is very difficult to measure because feelings of comfort or discomfort change throughout the stay, a time in which survey administration is unlikely, if not impossible. To compensate for this problem, during-stay comfort is typically measured through the proxy of post-stay satisfaction surveys (Gunderson, Heide, & Olsson, 1996; Min, et al., 2002; Saleh & Ryan, 1992; Segarra-Ona, Peiro-Signes, Verma, Mondejar-Jimenez, & Vargas-Vargas, 2014).

Post-stay satisfaction

The most common measurement of guest perceptions of their hotel stay is post-stay satisfaction. In surveys conducted after a stay, guests may reveal their willingness to pay for a specific amenity, factors of importance to them or complaints about the quality of service (Atkinson, 1988; Cadotte, 1988; Dalton, Lockington, Baldock, 2008). By understanding guest satisfaction, hoteliers can better work to improve their product and grow their customer base (Atkinson, 1988).

The purpose of the survey in the Motel Optimization Project is to assess how a guest's comfort is affected by a hotel's energy efficiency. As outlined above, guest comfort, while the paramount concern of the hotel industry (Atkinson, 1988), is difficult to assess. Following other studies included in the literature review, our survey will be conducted immediately following the stay, while guests are still in the vicinity of the hotel (Min et al., 2002, Susskind & Verma, 2011).

THEORIES OF CUSTOMER SATISFACTION

Since the 1970s, academic interest in theories of customer satisfaction has grown immensely (Barsky, 1992). Two existing theories regarding how customers make choices are the rational choice theory and the disconfirmation theory. These theories operate in sequence under the economic principle that customers make decisions to optimize utility. Consumers make rational choices they feel will best suit their needs, based on previous knowledge and judgments. Once a decision has been made, customers establish expectations, and the confirmation or disconfirmation of these expectations lead to a sense of satisfaction or dissatisfaction (Barsky, 1992). Barsky posits that hotel guest satisfaction can be measured using these two theories.

GUEST COMFORT AND SUSTAINABLE PRACTICES

Interest in guest satisfaction and environmental sustainability practices has grown during the past three decades. The intersection of these two research areas has also been gaining popularity, particularly in the last ten years. The following three sections outline key findings from the existing literature in these research areas as they relate to the current project.

Determinants of guest comfort

Researchers have attempted to determine which physical features and staff-related elements of the hotel are most important to guest comfort and post-stay satisfaction. While the results of each study varied, the factors frequently identified as important to guest comfort are quietness of the room, safety, cleanliness, and employee attitude (Atkinson, 1988; Cadotte, 1988; Gunderson, et al., 1996; Lewis, 1984). Physical attributes of the room, such as bed comfort or lighting, while not as important, still had significant effects on overall satisfaction (Barsky, 1992; Gunderson, et al., 1996). In short, both physical and staff-related elements are important to post-stay satisfaction, despite variance in guest preferences across demographics and hotel types (Saleh & Ryan, 1992).

Guest preference of sustainable practices

Dalton, et al. (2007) examined the role of renewable energy sources (RES) in Australian hotels. They selected four hotels which were operating under RES or other energy efficiency measures and examined guest support for these systems. Through surveys and interviews of guests and staff, the researchers found that guests tended to be very supportive of energy efficiency measures in the lodging sector. Over 70 percent of survey respondents expressed willingness to reduce energy use by reducing use of heaters and air conditioners. Sixty percent of the respondents would be sympathetic to a power outage or black out if they knew it was due to malfunctioning of the RES system. In addition, nearly half of the respondents would be willing to pay more for hotels implementing energy efficiency measures, with acceptable cost increase between 5percent and10percent.These results were unprecedented, both in terms earlier researching findings and perceptions of hotel operators. The researchers argued that the findings suggest that researchers and hoteliers had "underestimate[d] both tourist confidence in RES and their willingness to accommodate any inconveniences arising from RES" (Dalton, et al., 2007, p.2183). In other words, the researchers attributed their findings to changing attitudes towards energy efficiency and sustainability in hotel design and operation.

Millar and Baloglu (2011) surveyed 571 travelers about their preferences for sustainable attributes in U.S. hotels. They asked guests to identify the most important of seven attributes, including a recycling policy, refillable shampoo dispensers, controlled lighting, energy efficient bulbs, towel and linen reuse programs, and green certification. These attributes were selected based on a literature review of green certification programs, guest preferences, and the researchers' own pilot study. The

researchers found that green certification and energy efficient bulbs were the most important factors for guests. Moreover, cues such as certification are exceptionally helpful in determining at which hotel to stay. One problem with certification (e.g., the US Green Building Council's LEED Certification) is the prohibitive cost, which has resulted in a very small number of hotels that have sought certification. Unlike Dalton et al. (2007), Millar and Baloglu found that most customers were not willing to pay higher prices for green attributes and attributed the finding to the price sensitive characteristics of leisure travelers. The researchers concluded with the argument that additional research is needed to examine the effects of green attributes on guest comfort in different types of hotels.

Effects of sustainable practices on guest comfort and hotel operations

In recent years, "going green" has become increasingly important for hoteliers and guests (Barber, 2014; Bohdanowicz, 2005; Millar & Baloglu, 2011). Multiple studies have measured tangible changes to business practices while providing managers with tools to better run their operations (Becken, Frampton, & Simmons, 2001; Chan & Lam, 2003; DeFran, 1996). These best management practices include recommendations for changes in energy efficiency, waste management, and water conservation, both in guest rooms and common spaces (DeFran, 1996). Research on sustainability in the lodging sector has also assessed employee training programs and guest attitudes. The combination of physical changes, as well as changes in hotel management and staff training can help increase the importance and success of sustainability in hotel operations (Bohdanowicz, 2005; Bohdanowicz, Zientara, & Novotna, 2011; Kasim, 2004). Guests' demands for environmentally friendly accommodations have also played an increasing role in facilitating sustainable practices in the lodging sector (Barber, 2014; Han, Hsu, Li & Sheu, 2011; Millar & Baloglu, 2011).

The effects of sustainable practices can be measured through guest perceptions and satisfaction, as well as changes in hotel operation costs. Susskind and Verma (2011) monitored the impact of lighting and television improvements on guest satisfaction at the Statler Hotel at Cornell University. Neither overall satisfaction with television quality nor satisfaction with television picture quality differed by energy setting. Additionally, bathroom lighting conditions did not make a significant difference in satisfaction with bathroom lighting. Other studies that have measured the integration of sustainable features into hotel operations have focused on energy costs and the hotel's bottom line. Tested features include timers, occupancy sensors, low energy-consuming materials, renewable energy sources, and heat pumps for pools (Chan & Lam, 2003; Erdogan & Tosun, 2009; Meade, 2014). While these studies measured the monetary and energy use effects of various upgrades, they did not examine the effect of energy efficiency on guest comfort, which is "the primary consideration in any hotel building project" (Energy Star, 2008, p. 2).

SURVEY METHOD

Since the 1970s, interest in methods, strategies and best practices for tracking hotel guests' expectations, comfort, and satisfaction has grown. Researchers have been able to better understand guest preferences and to use that data to inform best practices for hotel managers, through detailed surveys and interviews (Lewis & Pizam, 1981). Therefore, survey methods have evolved to enable researchers to obtain higher quality data. Some of the evolutions include providing space for comments, the use of a Likert scale, inclusion of "neutral" or "not applicable" as answer options, and clear, direct questions (Lewis & Pizam, 1981; Schall, 2003).

SUMMARY

Clearly, there has been extensive research on hotel guests' expectation and satisfaction. There has also been growing attention on the sustainable practices of hotels and guest attitudes toward these practices. Much less research has been conducted to assess how hotels' sustainable practices influence guests' perceived comfort or satisfaction. Therefore, the purpose of the current guest survey is to assess whether and how hotels' energy efficiency performance, which is an aspect of sustainability, affects guests' perceived comfort.

METHODOLOGY

Questionnaire

The guest comfort questionnaire was developed based on previous research findings (see Appendix B for a copy of the actual questionnaire). The questionnaire included items directly related to energy efficiency and corresponded with technical data collection, including temperature control and consistency, noise level of the heating and cooling unit, ambient noise, water temperature and pressure, lighting, and air quality. Respondents also answered questions about bed comfort and room cleanliness—two factors, according to previous research, that are highly relevant to overall room experience. Both the lighting and air quality items were measured using a 1-7 scale, where the mid-point was "about right" while both higher and lower scores reflected less satisfactory quality. Specifically, for the lighting item, 1=too dim, 4=nicely lit, and 7=too bright. For the air quality item, 1=too dry, 4=about right, and 7=too humid. All other items were measured on a 7-point Likert scale, with higher scores reflecting greater satisfaction or desirability. For all items, a "not applicable" option was available.

Survey Sites

The guest comfort survey was administered in four hotels in the Minneapolis-Saint Paul Metropolitan Area and one hotel in Rochester, Minnesota. All five hotels were built between 1994 and 2000. In each of the five hotels, the survey took place in the breakfast room, given its central location and the high volume of guests using the space each morning. All but one hotel offered a complimentary breakfast to its guests. As an incentive, each respondent who completed the questionnaire received a five-dollar gift card to a coffee shop.

Survey Process

For one hotel in Minneapolis, the survey was administered in two mornings—on a Saturday and then a Wednesday. The survey was administered in one morning for each of the other four hotels, with three on Wednesdays and one on a Thursday. A trained research assistant from the University of Minnesota approached guests in the breakfast room of each hotel and asked if the guest would be interested in completing a questionnaire. Most respondents completed the questionnaire themselves. However, a few questionnaires were administered verbally, with the research assistant reading aloud the questions and answer options.

Technical Data Collection

A team of engineers audited each of the five hotels to analyze energy efficiency opportunities. Data collected at each hotel is shown in Table 1.

Since comfort is a subjective perception that involves multiple aspects during guests' stay, relating the technical data to specific survey questions of comfort was an imperfect effort. Some relationships are more intuitive (e.g., dimness to perceived lighting); others, such as temperature control and consistency, were more challenging.

The categorization of technical data faces two challenges. First, there was not always variability among the five hotels. For instance, they had similar performance in terms of shower head flow and room tightness. Second, a value code was assigned to each of the five hotels for every technical measurement. However, it is not clear whether performance moderately below or above the

recommended code is desirable. For instance, ventilating at greater than 50 CFM may not be better than ventilating at 50 or even 45 CFM. For the analyses reported in this document, the hotels were grouped according to similarity in value code for each technical measurement to the best of our ability.

Table 1: Data collected during Engineering Assessment

Building Description and Bill Data	Equipment Specifications	Field Measurements
Square footage Number of rooms Occupancy rate Gas usage history Electric usage history Water usage history	HVAC equipment efficiency Water heater efficiency Showerhead flow Faucet aerator flow Lighting types/wattage Control set-points	Exhaust fan flow Noise levels Light levels Room tightness (in relation to outside) Pool temperature Air temp and humidity

Data Entry and Analysis

Survey data was entered into Microsoft Excel (version 2010). The data file was checked and cleaned. Analysis provided percentages, means, medians, and standard deviations for all items on the questionnaire for each of the five hotels, as well as descriptive statistics of survey participants. To provide descriptive statistics for the lighting and air quality items, the data was recoded as follows:

Original Value	New Value
1 or 7	1
2 or 6	2
3 or 5	3
4	4

To understand the relationship between different aspects of guests' perceived comfort, Pearson correlation was used to examine bivariate correlations between the following four pairs of factors: (1) ease of temperature control and temperature consistency, (2) ambient quietness and quietness of the heating and cooling unit, (3) satisfaction with water temperature and with water pressure, and (4) sheet softness and towel softness. A *t*-test was used to assess whether or not perceived temperature consistency differed between those who adjusted the thermostat and those who did not. Additionally, regression was used to examine which factors had significant effect on guests' overall room experience.

To explore the correspondence between objective measures of hotel energy efficiency and guests' perceived comfort, technical data obtained through engineering audits was paired with guest survey data and merged into a single dataset. The technical data includes shower head flow, faucet aerator flow, water temperature, lighting output (for the headboard, desk, and vanity), the Energy Efficiency Ratio (EER) of heating/cooling equipment, average guest room tightness in cubic feet per minute (CFM), average CFM of exhaust fan, electricity usage, gas usage, and water usage. The merged dataset was then imported into SPSS (version 22.0) for further analysis. One-way Analysis of Variance (ANOVA), one-way Analysis of Covariance (ANCOVA), two-way ANCOVA, and *t*-test were conducted to assess whether guests' perceived comfort differed by hotels' energy efficiency performance. To conduct the analyses, the five hotels were divided into different categories according to their energy efficiency performance. Altogether, nine one-way ANOVA tests, three *t*-tests, two one-way ANCOVA

tests, and one two-way ANCOVA were conducted. See Table 2 for the categorization and ANOVA tests performed.

Table 2: Categorization of technical data and list of statistical tests performed

	Description	Categorization[1]				Statistical test	Outcome variable	Control variable(s)
		1	2	3	4			
Water Temperature	120 is the best practice. Settings lower than 120 require special laundry facilities	Hotel 1	Hotels 1, 4, and 5	Hotel 3	--	ANOVA	Satisfaction with water temperature	--
						ANOVA	Sheet softness	--
						ANOVA	Towel softness	--
Shower Head Flow	1.5 is recommended	Hotels 1 and 5	Hotels 2 and 4	Hotel 3	--	ANOVA	Satisfaction with water pressure	--
EER	The higher the better	Hotels 3 and 5	Hotels 1, 2 and 4	--	--	*t*-test	Temperature consistency	--
						t-test	Satisfaction with temperature control	--
						t-test	Quietness of the heating and cooling unit	--
Room Tightness	The lower the better[2]	Hotel 2	Hotels 1 and 3	Hotel 4	Hotel 5	ANOVA	Ambient quietness	--
Vanity Lighting	19 is the best practice. Below 19 is too dim; way above 19 is too bright	Hotel 2	Hotel 4	Hotel 5	Hotels 1 and 3	ANOVA	Lighting	--
Headboard Lighting		Hotel 4	Hotels 1 and 5	Hotel 2	Hotel 3	ANOVA	Lighting	--
Desk Lighting		Hotel 2	Hotel 5	Hotels 1 and 3	Hotel 4	ANOVA	Lighting	--
Exhaust Fan Rate	50 is the best practice. Below 50 may be humid; above 70 may be dry	Hotel 4	Hotels 3 and 5	Hotel 1	Hotel 2	ANOVA	Air quality	--
Energy Star Rating	The higher, the better	Hotel 5	Hotels 1 and 2	Hotels 3 and 4	--	ANCOVA	Overall room experience	Bed comfort, room cleanliness
Gas Usage	The less used, the better	Hotels 1 and 2	Hotels 3 and 5	Hotel 4	--	ANCOVA	Overall room experience	Bed comfort, room cleanliness
Electricity Usage		Hotel 3	Hotels 1 and 2	Hotels 4 and 5	--			

Water Usage		Hotels 2 and 5	Hotel 1	Hotels 3 and 4	--	ANCOVA	Overall room experience	Bed comfort, room cleanliness

[1]The higher the category number, the higher the score on a technical variable.
[2]While the 5 hotels have been categorized, there was very little difference between air flow rates.

RESULTS

Descriptive statistics

Guest room amenities

Overall, the level of satisfaction with various aspects of the guest room was high (Table 3, Figure 1). Respondents were highly satisfied with water temperature, and there was little variation in the level of agreement (as indicated by a small standard deviation). Guests were also fairly satisfied with water pressure and room temperature control, with average ratings close to 6 out of 7. The ratings for bed comfort, sheet and towel softness, as well as temperature consistency were high as well, with an average between 5.6 and 5.8. The two aspects with the lowest average ratings were ambient quietness and quietness of the heating and cooling unit—the former had an average just above five, and the latter had an average below five.

Table 3: Summary statistics of perceived room amenities

	Mean[1]	Median[1]	SD
Satisfaction with Water Temperature (n=124)	6.20	7	1.20
Satisfaction with Water Pressure (n=124)	5.98	7	1.38
Satisfaction with Temperature Control (n=116)	5.87	6.5	1.38
Bed Comfort (n=125)	5.80	6	1.44
Sheet Softness (n=122)	5.70	6	1.16
Temperature Consistency (n=122)	5.66	6	1.40
Towel Softness (n=125)	5.64	6	1.23
Ambient Quietness (n=124)	5.10	5	1.47
Quietness of the Heating and Cooling Unit (n=122)	4.74	5	1.65

[1]Rated on a scale where 1=Least satisfactory, 4=Neutral, 7=Most satisfactory

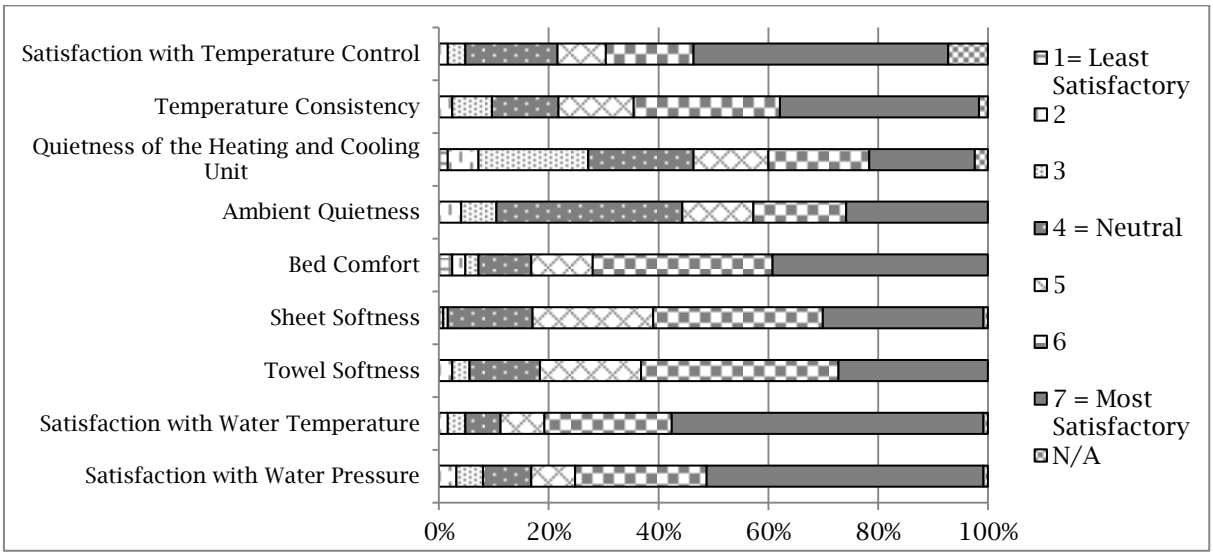

Figure 1: Guest ratings of perceived room amenities (n=125)

Setting room temperature

About 72 percent of the respondents (n=89) adjusted the thermostat in their guest rooms during their stay (Figure 2). Among the 89 respondents, 26 percent set the temperature at 68 degrees Fahrenheit and 20 percent at 70 degrees (Figure 3). The average temperature the respondents set was 70 degrees Fahrenheit, and the variation in temperature setting was small (Table 4).

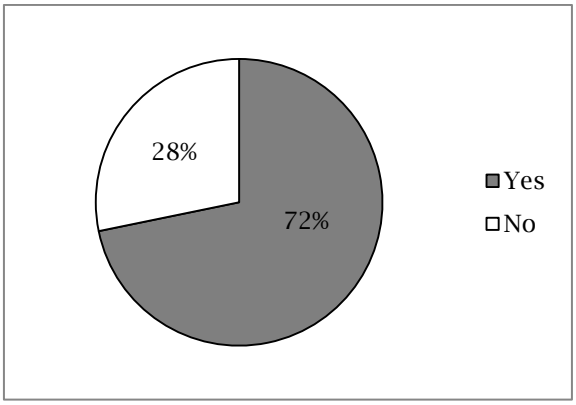

Figure 2: Percentage of respondents who did and did not adjust thermostat in room (n=124)

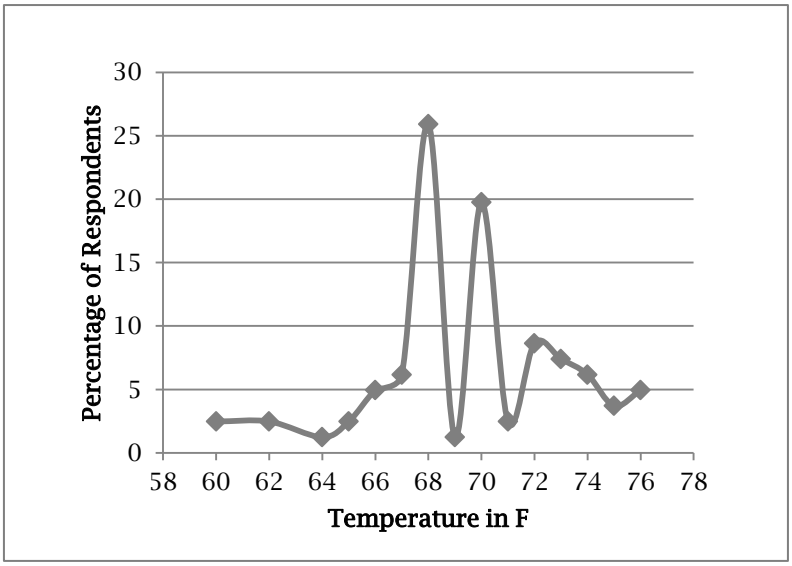

Figure 3: Percentage of respondents setting different temperatures in room (n=81)

Table 4: Summary statistics of respondents' in-room temperature setting (n=89)

Mean[1]	Median[1]	SD
70	70	3.50

[1]In Degrees Fahrenheit

Light and air

Both air quality and lighting received high ratings from the respondents (Table 5, Figure 4). About 75 percent of the respondents rated the air in the room "about right"—neither too dry nor too damp. A little over 70 percent rated the room as nicely lit, neither too dim nor too bright.

Table 5: Summary statistics of perceived lighting and air quality (n=125)

	Mean[1]	Median[1]	SD
Air Quality	3.68	4	0.60
Lighting	3.65	4	0.61

[1]Rated on a scale where 1=Least satisfactory, 4=Neutral, 7=Most satisfactory

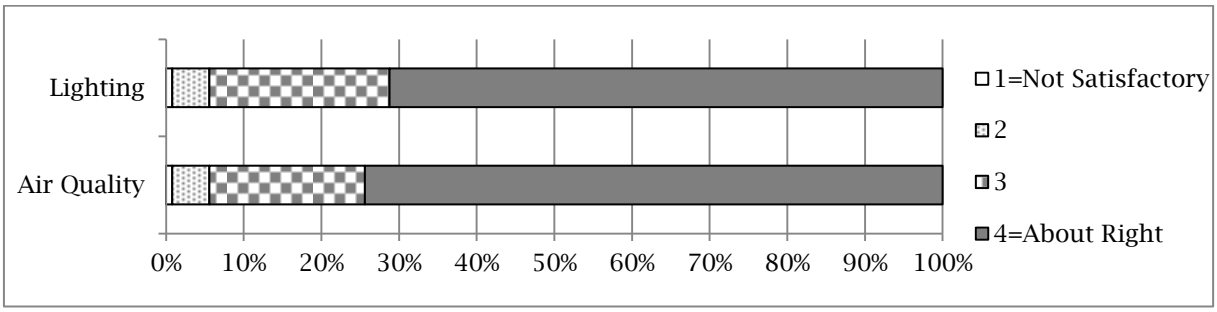

Figure 4: Respondents' ratings of lighting and air quality (n=125)

Overall room experience

The ratings for room cleanliness and overall room experience were high, both with an average above 6 (Table 6). Only about 10 percent of respondents rated the room cleanliness and overall room experience as neutral or worse (Figure 5).

Table 6: Summary statistics of respondents' overall room experiences (n=122)

	Mean[1]	Median[1]	SD
Room Cleanliness	6.19	7	1.13
Room Experience	6.11	6	1.09

[1]Rated on a scale where 1=Least satisfactory, 4=Neutral, 7=Most satisfactory

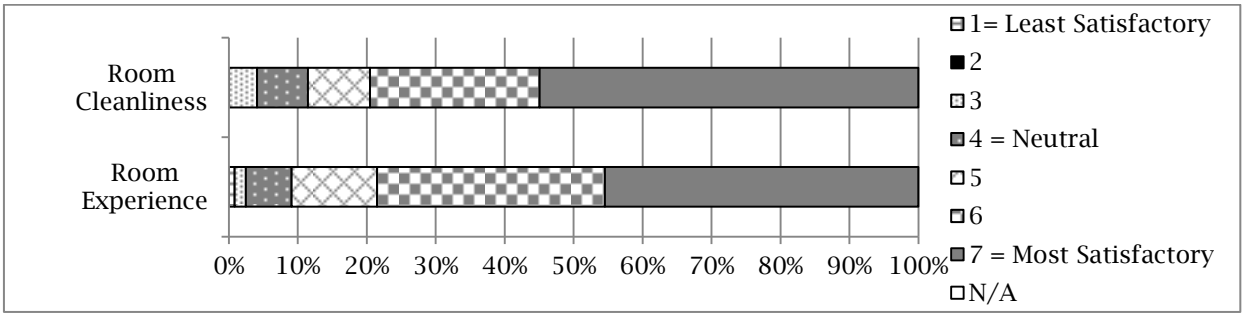

Figure 5: Respondents' ratings of overall room experiences (n=122)

Hotel qualities, room amenities, and energy efficiency certification

Location was the most important quality that respondents considered when choosing a hotel, as identified by close to 80 percent of the respondents (Figure 6). Room comfort and cost were the next two most important hotel qualities, identified by more than 60 percent of the respondents. Close to 50 percent of respondents identified hotel amenities and previous experience as important qualities to consider when choosing a hotel. The remaining three qualities—hotel brand, guest reviews, and availability of special packages—were important to no more than 35 percent of respondents.

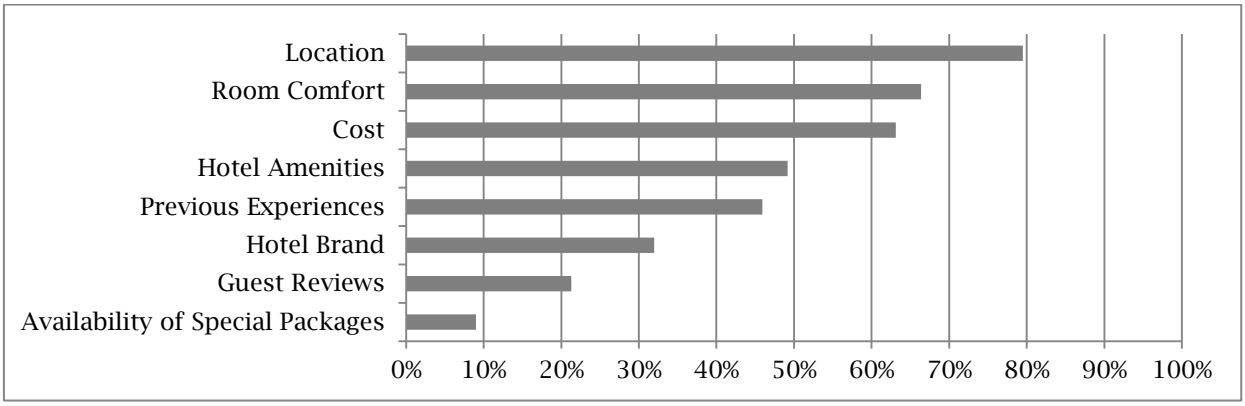

Figure 6: Important qualities to consider when choosing a hotel. Multiple responses allowed. (n=122)

More than 90 percent of the respondents identified cleanliness, and close to 80 percent identified bed comfort as important hotel amenities that make their stay comfortable (Figure 7). There were also more than 50 percent of respondents identifying quietness and friendly staff as important to a comfortable stay. Room temperature is important to a little more than 40 percent of the respondents. No more than 25 percent of the respondents identified bathroom amenities, hotel common areas, or room lighting as amenities important to a comfortable stay.

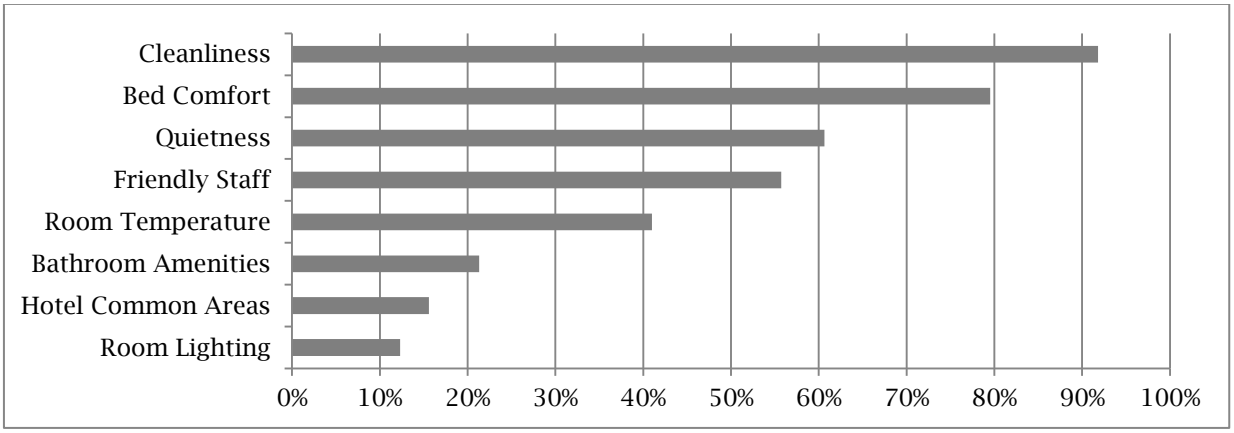

Figure 7: Hotel amenities important to a comfortable stay. Multiple responses allowed. (n=122)

If other criteria (e.g., cost, location) were comparable, 60 percent of respondents would choose a hotel that was certified as energy efficient (Figure 8), 36 percent of the respondents would not, and 4 percent preferred not to answer the question.

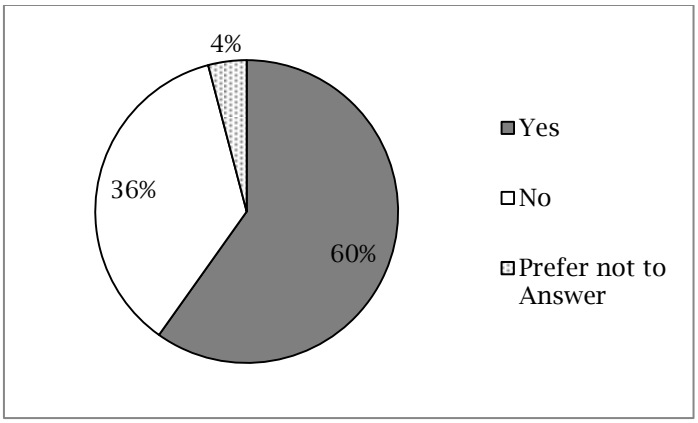

Figure 8: Percentage of respondents who would and would not choose an energy efficient hotel (n=122)

Trip purpose and previous hotel experiences

Close to 60 percent of respondents had not stayed at the property before (Table 7). Of the 43 percent who had stayed at the property before, half had stayed one to three times. Sixty percent of respondents traveled for business purposes, 23 percent for leisure, 7 percent for a combination of business and leisure, and 10 percent for purposes other than business or leisure. Finally, 51 percent of respondents had previously complained to a hotel because a room was uncomfortable, and 48 percent had not. Guests also provided additional, qualitative comments about their stay at the end of the questionnaire (see Appendix C for actual comments).

Table 7: Trip purpose and previous hotel experiences of respondents

	Frequency	Percentage (percent)
Have you stayed at this hotel before? (n=122)		
No	70	57percent
Yes	52	43percent
1 – 3	26	50percent
4 – 6	9	17percent
7 – 10	9	17percent
More than 10 times	8	16percent
Please indicate the purpose of your trip (n=121):		
Business	73	60percent
Leisure	28	23percent
Business and Leisure	8	7percent
Other	12	10percent
Have you ever complained to a hotel because a room was uncomfortable? (n=120)		
Yes	61	51percent
No	58	48percent
Prefer not to answer	1	1percent

Relationships among different aspects of guest room experience

Bivariate correlations between all four pairs of variables were significantly positive at the 0.01 level (Table 8).The correlation for three of the four pairs was greater than 0.40, with the fourth pair (sheet softness and towel softness) lower than 0.30.

Table 8: Summary of Pearson Correlation results (n=125)

Variables	Pearson Correlation
Satisfaction with temperature Control, Temperature Consistency	.426*
Quietness of the Heating and Cooling Unit, Ambient Quietness	.524*
Satisfaction with Water Pressure, Satisfaction with Water Temperature	.588*
Sheet softness, Towel softness	.265*

*Significant at .01 level

Perception of temperature consistency differed significantly (t=2.47, p=0.016) between respondents who adjusted the in-room thermostat and those who did not (Table 9). Guests who did not adjust the in-room thermostat perceived room temperature to be significantly more consistent than those who adjusted the thermostat.

Table 9: *t*-test results comparing temperature consistency perception between guests who adjusted thermostat and those who did not

Thermostat adjustment	n	Mean	SD	*t*-value	df
Yes	88	5.49	1.48	2.47*	79
No	33	6.09	1.07		

*p<0.05

Room cleanliness (β=0.37, p<0.0005) and bed comfort (β=0.26, p=0.001) had significant effects on a guest's overall room experience. Guests who perceived the room as clean, or perceived the bed as comfortable, were more likely to rate the overall room experience highly. None of the other 10 factors had a significant effect on overall room experience (Table 10).

Table 10: Summary of multiple regression analysis for respondents' overall room experience (n=125)

Variable	B	SE (B)	β
Lighting	0.15	0.14	0.08
Air Quality	0.18	0.13	0.10
Satisfaction with Temperature Control	0.05	0.07	0.06
Temperature Consistency	0.08	0.07	0.11
Quietness of the Heating and Cooling Unit	0.08	0.06	0.12
Ambient Quietness	0.01	0.06	0.01
Bed Comfort	0.20	0.06	0.26*
Sheet softness	0.09	0.08	0.101
Satisfaction with Water Pressure	-0.00	0.08	-0.00
Satisfaction with Water Temperature	-0.01	0.10	-0.01
Towel softness	-0.02	0.08	-0.02
Room Cleanliness	0.37	0.09	0.37*

*p<0.01

Linking technical data to guest perception

To understand the effect of a hotel's energy efficiency on a guest's perceived comfort, we assessed whether hotels' energy efficiency performances made significant differences in corresponding perceived comfort measures. For example, we assessed whether a hotel's room tightness made a difference in a guest's perception of ambient noise. Altogether, there were three statistically significant findings: (1) exhaust fan rating made significant differences in perceived in-room air quality; (2) EER rating made significant differences in perceived temperature consistency; and (3) hotels' gas usage made significant differences in guests' overall room experience.

The first significant finding is that guests from hotels with different exhaust fan ratings perceived in-room air quality differently (F=5.31, p=0.002; Table 11). Specifically, guests staying in Hotel 2 perceived in-room air to be significantly drier than those staying in Hotel 1. Indeed, Hotel 2 had an exhaust fan rating of 85, which is higher than Hotel 2's, which was 69. Meanwhile, guests staying in Hotel 3 and 5 also perceived in-room air to be significantly drier than those staying in Hotel 1. However, Hotel 3 and 5 had an exhaust fan rating around 35, which indicates *humid* air! Therefore, the significant finding is the opposite of what would be expected.

It is important to note that, while satisfaction with water pressure did not differ significantly by shower head flow rate, the flow rates of the five hotels were similar to each other (differing by only .50 gpm), which may be the reason for the insignificant finding. Table 11 summarizes the findings of these tests.

Table 11: Summary of one-way Analysis of Variance and one-way Analysis of Covariance tests results

Dependent variable	Independent variable	n	Mean	SD	*F*
	Water temperature				
Satisfaction with water temperature	Hotel 2	22	6.41	0.85	0.78
	Hotels 1, 4, and 5	79	6.10	1.26	
	Hotel 3	23	6.35	1.27	
	Water temperature				
Sheet softness	Hotel 2	22	5.33	1.09	1.67
	Hotels 1, 4 and 5	78	5.82	1.23	
	Hotel 3	22	5.64	0.90	
	Water temperature				
Towel softness	Hotel 2	22	5.68	1.36	1.36
	Hotels 1, 4 and 5	80	5.74	1.11	
	Hotel 3	23	5.26	1.48	
	Shower head flow				
Satisfaction with water pressure	Hotels 1 and 5	37	5.84	1.44	0.33
	Hotels 2 and 4	64	6.00	1.36	
	Hotel 3	23	6.13	1.39	
	Vanity lighting				
Perceived lighting[3]	Hotel 2	22	3.95	0.49	0.73
	Hotel 4	43	3.95	0.72	
	Hotel 5	15	3.67	0.62	
	Hotels 1 and 3	45	3.96	0.80	
	Head board lighting				
Perceived lighting[3]	Hotel 4	43	3.95	0.72	0.44
	Hotels 1 and 5	37	3.81	0.70	
	Hotel 2	22	3.95	0.49	
	Hotel 3	23	4.00	0.85	
	Desk lighting				
Perceived lighting[3]	Hotel 2	22	3.95	0.49	0.73
	Hotel 5	15	3.67	0.62	
	Hotels 1 and 3	45	3.96	0.80	
	Hotel 4	43	3.95	0.72	
	Exhaust fan rating				
Air quality[3]	Hotel 4	43	4.07	0.51	5.31*
	Hotels 3 and 5	38	3.82	0.83	
	Hotel 1	22	4.45	0.60	
	Hotel 2	22	3.82	0.59	
	Room Tightness[2]				
Ambient quietness	Hotel 2	22	5.18	1.62	0.30
	Hotels 1 and 3	44	4.95	1.56	
	Hotel 4	43	5.23	1.41	
	Hotel 5	15	5.00	1.25	
	Energy Star Rating				
Overall room experience[1]	Hotel 5	22	6.35	0.67	1.75
	Hotels 1 and 2	37	5.81	1.43	
	Hotels 3 and 4	66	6.20	0.95	
	Water Usage				
Overall room experience[1]	Hotels 2 and 5	35	5.99	1.45	0.60
	Hotel 1	21	6.14	0.72	
	Hotels 3 and 4	65	6.16	1.09	

*$p<0.005$. [1]Effects of bed comfort and room cleanliness controlled for. [2]There is little difference between room tightness across all five hotels. [3]Adjusted to a 1-4 scale.

The EER rating of the heating/cooling unit in each room was used as an indicator of the age and quality of the heating and cooling unit. A higher EER was also assumed to indicate a quieter unit that

would maintain a set point more accurately and be easier to control. Respondents from hotels with different EER ratings perceived in-room temperature consistency differently (t=-3.08, p=0.003; Table 12). Specifically, guests staying in hotels with higher EER perceived the temperature to be more consistent than those staying in hotels with lower EER.

Table 12: *t*-test results comparing perceived temperature consistency, ease of temperature control, and quietness of heating and cooling unit between hotels with lower EER and those with higher EER

	EER	n	Mean	SD	*t*-value	df
Temperature Consistency	Hotels 3 and 5	36	5.00	1.67	-3.08*	50
	Hotels 1, 2, and 4	86	5.94	1.17		
Ease of Temperature Control	Hotels 3 and 5	34	5.76	1.58	-0.49	52
	Hotels 1, 2, and 4	82	5.91	1.30		
Quietness of Heating and Cooling Unit	Hotels 3 and 5	37	4.38	1.83	-1.50	59
	Hotels 1, 2, and 4	85	4.89	1.55		

*p<0.05

Guests' overall room experience differed significantly by gas usage (F=10.37, p=0.002) but not electricity usage, after controlling for the effects of bed comfort and room cleanliness (Table 13). Specifically, guests staying in Hotel 1 and Hotel 2 rated their overall room experience as more comfortable than those staying in Hotel 3 or Hotel 5. The former two hotels used less gas than the latter two. Meanwhile, guests staying in Hotel 4, which used the most gas, also rated their overall room experience as more comfortable than those staying in Hotel 3 or 5. The gas usage in Hotel 4 was higher due to a full service restaurant on the premise.

Table 13: Summary of two-way Analysis of Covariance tests

		Overall room experience			*F*
		n	Mean	SD	
Gas usage[1]	Hotels 1 and 2	41	6.32	0.69	10.37*
	Hotels 3 and 5	37	5.51	1.45	
	Hotel 4	43	6.42	0.85	
Electricity usage[1]	Hotels 1 and 2	22	5.77	1.02	2.25
	Hotels 3 and 5	41	6.32	0.69	
	Hotel 4	58	6.09	1.31	

*p<0.005
[1]Effects of bed comfort and room cleanliness controlled for

DISCUSSION

Little research has examined the relationship between hotels' energy efficiency performance and guests' perceived comfort (see Susskind & Verma, 2011, as an exception). Therefore, the current study is among the first to fill this void and to provide initial insight into this increasingly important aspect of hotel operations. Overall, hotels' energy efficiency does not have much effect on guests' experience of comfort.

Cleanliness and bed comfort were the two most important aspects to a satisfactory hotel room experience, as documented in the literature (Barsky, 1992; Cadotte, 1988; Gunderson, 1996; Saleh & Ryan, 1992). One can assume that room comfort is primarily interpreted as these two amenities. In addition, only 60 percent of guests would choose an energy efficient hotel when presented two comparable options. Therefore, while it is not likely that energy efficiency will drive people to or away from a hotel, it is also not likely that energy efficiency improvement will be noticed by guests, as its impact on comfort seems minor.

The four pairs of significant correlations suggest that, when filling out the questionnaire, guests reflected on aspects of their in-room experience in a more general rather than specific way, making it difficult to associate any specific energy efficiency measure with guest perception. For example, a guest may have assessed overall room quietness, rather than differentiating between the quietness of the heating/cooling unit and ambient quietness. Similarly, guests may have assessed the shower experience as a whole, instead of as an experience that consists of both water temperature and water pressure.

The significant effect of EER rating of heating and cooling units on perceived comfort indicates that a more efficient unit makes a positive contribution to guests' perceived comfort. Hotel owners can confidently invest in more efficient units, knowing the investment will reduce their energy bills and improve (or at least maintain) guest comfort.

The significant effect of exhaust fan flow on air quality and that of gas usage on overall room experience are puzzling and need more information for appropriate interpretation. For the effect of exhaust fan on air quality, the most likely explanation is that the measurement of bath fan exhaust flow in CFM is not sufficient enough to explain perceived air quality. Other variables, such as fan location, window operation, room tightness, and common space ventilation, also affect air quality but were not available for the current analysis.

The effect of gas usage on guests' overall room experience was also intriguing, as guests staying in hotels with low gas use and those with high gas use rated their experience as more satisfactory than those staying in hotels with moderate gas use. All five hotels were built between 1994 and 2000. From an engineering perspective, the five hotels do not differ much in equipment efficiency. Therefore, it is unlikely that the significant effect of gas use is a spurious effect of recent renovation or variations in equipment. The survey was administered between May 31 and June 4 with higher than historical average temperatures of above 80 degrees Fahrenheit. Therefore, it is unlikely that guests were concerned with heating when they responded to the survey. One possible explanation is hotel management practice. Regular maintenance helps reduce gas use and may contribute to guest comfort.

Aside from the significant findings, the insignificant results also provided valuable insights. Hotels do not have to use a lot of water to create satisfactory room experience for guests, as water usage had no effect on guests' overall room experience. It is also encouraging that a hotel's water temperature setting did not matter to guest satisfaction with either water temperature, perceived sheet softness, or perceived towel softness. Hotels with high water temperature settings can be

encouraged to lower the setting to save energy without hampering guest experience. Furthermore, hotels can reduce lighting levels (desk, vanity, and headboard), as none of these lighting factors had significant effect on guest satisfaction, and room lighting is the least important hotel amenity, according to the survey finding. In terms of shower head flow, a 0.5 gallon per minute (gpm) difference (2.5 versus 2.0) is sizable, although no hotel had a "low-flow" showerhead rated at 1.5 or less gpm. The lack of difference in satisfaction with water pressure or temperature between guests staying in hotels with 2.5 gpm and those with 2.0 gpm offers hope that further reduction in water pressure to reach "low-flow" status may go unnoticed and create no adverse effect on guest comfort.

Lastly, several aspects of the survey process are worth discussion. First, the question that asks respondents whether they would choose an energy efficient hotel, assuming other criteria were comparable, spans two lines. It is possible that some respondents answered the question without reading the entire question, especially the second line of the question that reads "assuming other criteria (e.g., cost, location) were comparable." Therefore, answers to this question may not reflect hotel guests' actual preference for energy efficiency hotels when other criteria are comparable. Second, the survey mostly took place on weekdays rather than weekends, which may explain the finding that more respondents were business rather than leisure travelers. The prevalence of business travelers, in turn, may explain the unimportance of hotel brand and special package availability as hotel amenities. Many businesses and organizations have pre-arranged contracts with certain hotel brands, leaving little to no choice to the individual business travelers in terms of hotel brand and special package availability. The third aspect of the survey process worth noting is access to potential respondents. All but one hotel offered free breakfasts to guests. This situation may have affected the sample at the hotel with a paid breakfast, as some guests did not have breakfast in the hotel, thus not being approached for the survey. Additionally, a complimentary airport shuttle (where available) may provide an additional opportunity to approach guests for the survey but was not exploited in the current study.

APPENDIX A: ANNOTATED BIBLIOGRAPHY

The following publications were consulted in order to better understand the role of energy efficiency in the lodging sector. The subject of the currently published literature falls into seven major categories: American studies in sustainable lodging, international studies in sustainable lodging, tools for hotels, guest satisfaction, determinants of guest comfort, guest attitudes towards green practices, and research methodology.

American studies in sustainable lodging

Minnesota Technical Assistance Program (2011). *Pollution Prevention and Energy Efficiency for Minnesota's Lodging Sector*. Minneapolis, MN: University of Minnesota.

This report examined energy efficiency measures in 27 Minnesota hotels. MnTAP used surveys and onsite checks to monitor and determine the available efficiency measures and associated costs, savings, and payback time. The report found that 81percent of hotels already practice some energy efficiency measures, with the most common being efficient lighting. While not included in the report, data collection was scheduled to last an additional two years to further understand long term effects.

Nicholls, S., & Kang, S. (2012a). Going green: the adoption of environmental initiatives in Michigan's lodging sector. *Journal of Sustainable Tourism, 20* (7), 953-974.

Nicholls and Kang surveyed 217 Michigan hotels, most of which were small, independent properties in rural areas of the state. Their survey attempted to determine which green practices were most common in these properties. They found the most common was linen and towel reuse (84percent of properties). In terms of energy efficiency, using efficient light bulbs and Energy-Star appliances were most common (64-77 percent), whereas key card activated electricity was rarely employed (11 percent).

Nicholls, S., & Kang, S. (2012b). Green initiatives in the lodging sector: Are properties putting their principles into practice? *International Journal of Hospitality Management, 31*, 609-611.

This article was a continuation of Nicholls and Kang's previous study of employing green tools in Michigan hotels. Working with the same set of hotels, they were able to determine the gap between what hotel operators felt they should be doing and if those practices were actually being adopted. They found the margin of difference was small for some measures, such as a linen and towel reuse program (86 percent believe it should happen compared to 84 percent employing it). However, the margin was quite large in the case of environmental certification (54 percent compared to 12 percent). They attributed these differences to structural barriers to implementation.

Smerecnik, K., & Andersen, P. (2011). The diffusion of environmental sustainability innovations in North American hotels and ski resorts. *Journal of Sustainable Tourism, 19* (2), 171-196.

Smerecnik and Andersen surveyed 49 hotels and ski resorts to determine which environmentally friendly practices were being implemented and why. Ski resorts were selected because they rely on the natural environment for profit and typically support environmentally conscious guests. One of their survey categories was energy efficiency, and 90 percent of the hotels employed one or more

energy efficiency practices. The authors concluded the simplicity of environmental practices was the largest predictor in whether or not it would be employed.

Zhang, J., Jogelkar, N., & Verma, R. (2012). Pushing the frontier of sustainable service operations management: Evidence from us hospitality industry. *Journal of Service Management, 23 (3)*, 377-399.

This study examined the relationship between sustainability practices and operating performance in hotels across the United States. The authors found hoteliers were often unaware of the economic benefits of sustainability measures, which was a major barrier to implementation. Their research found that customer behavior drove demand for hotel sustainability, so it is recommended hotel owners and operators consult guests more.

Zhang, J., Jogelkar, N., Verma, R., & Heineke, J. (2014). Exploring the relationship between eco-certifications and resource efficiency in us hotels. *Cornell Hospitality Report, 14 (7),* 4-16.

This study examined the connections between eco-certification and the use of resources by both hotels and consumers. The researchers assessed the consumption of water, energy, and waste in more than 2,000 hotels. They found that hotels constrained by an environmental certification and audit process consumed fewer resources. Guests at these eco-certified properties were also more likely to consume less as well.

International studies in sustainable lodging

Becken, S., Frampton, C., & Simmons, D. (2001). Energy consumption patterns in the accommodation sector: The New Zealand case. *Ecological Economics, 39*, 371-386.

This study of the New Zealand accommodations industry attempted to determine the difference between lodging types and energy usage. Energy use was monitored year-round at a variety of lodging types, and costs spent on energy and fuel type were recorded. Resulted indicated that hotels consumed the most energy and used primarily electricity to operate. However, much variation in the data existed due to differences in business size and the amount of visitor-nights per year.

Bohdanowicz, P. (2005). European hoteliers' environmental attitudes: Greening the business. *Cornell Hotel and Restaurant Administration Quarterly, 46*(2), 188-204.

This study focused on the differences between chain and independent hotels in Europe and their perceptions of "greening" the lodging industry. The researcher found that hoteliers, especially independent ones, had relatively low levels of interest in environmental protection and were often meeting minimum compliance levels. However, an increase of awareness and customer-driven demand for green practices would likely change hotel operations.

Bohdanowicz, P. (2006). Environmental Awareness and Initiatives in Swedish and Polish Hotel Industries: Survey Results. *Hospitality Management, 25*, 662-682.

Bodanowicz's study focused on environmental practices in Swedish and Polish hotels. These two countries were chosen because Sweden is considered to be much more environmentally progressive

than Poland and has policies in place for promoting green tourism. Bodanowicz found that, while hoteliers in both countries worked to reduce energy costs, environmental awareness and the presence of nation-wide standards were much more prevalent in Sweden.

Bohdanowicz, P., Zientara, P., & Novotna, E. (2011). International hotel chains and environmental protection: An analysis of Hilton's *We Care!* programme (Europe, 2006-2008). *Journal of Sustainable Tourism*, *19*, 797-816.

Bohdanowicz, Zientara, and Novotna analyzed the success of the European Hilton's *We Care!* Programme. The program was employed as a way to promote environmental awareness and stewardship, both in the hotel and in the daily lives of workers. The Hilton was able to achieve their goal of increased sustainability and gain popularity through online intranet training courses, and by operating as a "grassroots" campaign.

Chan, W., & Lam, J. (2003). Energy-saving supporting tourism sustainability: A case study of hotel swimming pool heat pump. *Journal of Sustainable Tourism, 11* (1), 74-83.

Chan and Lam focused on the viability of using heat pumps as a means to heat swimming pools in Hong Kong. The success of the pump was monitored throughout the winter months, and costs and emissions were analyzed. The authors found that, despite high capital costs, the heat pump is an economical investment in the long term for both Hong Kong and other regions with similar climates.

Erdogan, N. & Tosun, C. (2009). Environmental performance of tourism accommodations in the protected areas: Case of Goreme Historical National Park. *International Journal of Hospitality Management, 28*, 406-414.

Erdogan and Tosun examined the tourism industry in Anatolia, Greece and to what extent the 140 hotels in the area employed sustainable practices. Energy saving light bulbs, low energy consuming materials, and solar energy were the most commonly used energy conserving tools among the seven energy efficiency practices assessed. The authors concluded that, overall, hotels in the region showed low levels of energy efficiency.

Erdogan, N., & Baris, E. (2007). Environmental protection programs and conservation practices of hotels in Ankara, Turkey. *Tourism Management, 28*, 604-614.

Erdogan and Baris interviewed and administered questionnaires to 54 hotel managers in Ankara, Turkey to determine which elements of environmental protection were being integrated into day to day operations. They focused on many attributes of environmental protection, including energy efficiency. The authors found that, while managers were interested in the cost savings associated with energy efficiency, many barriers to implement environmental measures existed, including a lack of legal framework and support and a lack of interest in sustainability.

Tools for Hotels

Bohdanowicz, P., Zientara, P., & Novotna, E. (2011). International hotel chains and environmental protection: An analysis of Hilton's *We Care!* programme (Europe, 2006-2008). *Journal of Sustainable Tourism*, *19*, 797-816.

At the end of the report of Hilton's *We Care!* programme, the authors outlined key strategies to replicate or adapt the program to different hotels. They noted that setting goals, working closely with employees to provide support, and adopting a holistic attitude towards environmentalism were all pillars to a strong hotel sustainability program.

DeFran, A. (1996). Go green: An environmental checklist for the lodging industry. *Cornell Hotel and Restaurant Administration Quarterly, 37,* 84-85.

DeFran provided a short, accessible checklist for hotel managers and operators to determine if they are being environmentally conscious. The checklist was divided into three areas: energy, solid waste, and water. Within the energy category, hotels could improve efficiency in a variety of areas: guestrooms, common areas, housekeeping, and maintenance.

Energy Star (2007). Facility type: Hotels and motels. In *Energy Star Building Upgrade Manual* (pp. 1-18). Washington, DC: Environmental Protection Agency.

This chapter of the Energy Star Building Manual was focused on energy efficiency measures in hotels, providing general background and specific examples of improvements. It also noted the importance of guest comfort and how to best balance comfort with energy efficiency. It served as a tool and provided resources for hotel operators to start improving efficiency.

United Nations World Tourism Organization. (2014). *Hotel Energy Solutions (HES) e-Toolkit*. Retrieved from http://hes-unwto.org/HES_root_asp/index.asp?LangID=1 on February 17, 2014.

The HES Energy Toolkit by United Nations World Tourism Organization is a free online calculator that helps businesses track their energy usage and performance. Based on survey information, the calculator will provide assessments and recommendations for further energy savings. Currently, the calculators are only available to small and medium-sized European hotels, but general resources are also available on the site, including best practices, as well as sample reports and suggestions for hotels.

Meade, B. (2014). Top 5 environmental management strategies affecting your hotel's bottom line. *Hotel Business Review*. Retrieved from https://hotelexecutive.com/business_review/483/top-5-environmental-management-strategies-affecting-your-hotelpercentE2percent80percent99s-bottom-line on February 17, 2014.

Meade suggested a framework and series of related tools to improve energy efficiency in hotels, including timers, occupancy sensors, and thermostatic controls as cost effective energy savings technologies. Meade also suggested that hotels take advantage of local and federal tax incentives and develop an environmental management plan to monitor progress.

Stipanuk, D. (2001). Energy management in 2001 and beyond: Operational options that reduce use and cost. *Cornell Hotel and Restaurant Administration Quarterly, 42,* 57-70.

Stipanuk began with a summary of the state of energy use in the lodging sector and then provided a set of steps to assist hotel managers with creating their own energy efficiency program. He argued that short and long-term goals were important and that monitoring energy use through inspections was the best way to determine which areas of the hotel can be improved. Stipanuk recommended that hotel operators work with staff, customers, and their utility providers to promote awareness of the project.

Withiam, G. (2010). Make sustainability a part of day-to-day hotel operations. *Hotel and Motel Management*. Retrieved from http://www.hotelmanagement.net/make-sustainability-a-part-of-day-to-day-hotel-operations on March 26, 2014.

Withiam reported on a roundtable event held by the Cornell Center for Hospitality Research that examined sustainability in the hotel industry. Using information gathered at the event, he provided a brief summary of tips for hotel managers, including ways to avoid "greenwashing", the benefits of some form of certification, and the importance of showing guests tangible results of green practices.

Guest satisfaction

Barsky, J. (1992). Customer satisfaction in the hotel industry: Meaning and measurement. *Journal of Hospitality & Tourism Research, 16*, 51-73.

Barsky gave an in-depth history and theory of customer choice and satisfaction in this paper. He used these theories to develop a model to test which factors of a hotel visit are most important to guests. After reviewing 450 guest comment cards, he concluded that employee attitude, hotel location, and room cleanliness were the most important factors for guests.

Cadotte, E., & Turgeon, N. (1988). Key factors in guest satisfaction. *Cornell Hotel and Restaurant Administration Quarterly, 28*, 44-51.

This study examined comment cards from both lodging establishments and restaurants. By determining which factors were most often complained about or complimented on, the researchers were able to determine which factors are most important to customers. Their analysis found that employee attitude, cleanliness, quality of service, and quietness of surroundings were most important, often recorded as both compliments and complaints by guests.

Determinants of guest comfort

Lewis, R. (1984). Isolating differences in hotel attributes. *Cornell Hotel and Restaurant Administration Quarterly, 25*, 64-77.

Lewis studied 17 factors that could influence guest perceptions, comfort, and post-stay satisfaction. He found that the most important factors across these categories were quality of services, security, and the “overall feeling.” His analysis also examined the different needs of different types of guests, e.g., business and leisure travelers, different age and income groups, as well as male and female guests.

Min, Ho., Min, Hy., & Chung, K. (2002). Dynamic benchmarking of hotel service quality. *Journal of Services Marketing, 16* (4), 302-321.

This study of hotels in Korea identified three major concerns to guests: cleanliness, quiet, and comfort. These factors were ranked using weights determined by guest surveys. The weights were then compiled to create benchmarks for monitoring guest comfort. The authors also discussed their methods and the difficulty of getting participants without small incentives.

Saleh, F., & Ryan, C. (1992). Client perceptions of hotels: A multi-attribute approach. *Tourism Management, June,* 163-168.

Saleh and Ryan tested 30 factors to determine which factors were important to guest comfort and whether or not they would return to the hotel. They found that a clean room, comfortable beds, and a quiet stay were the most important factors. However, there was significant variation in preference for different types of guests.

Guest attitudes towards green practices

Barber, N. (2014). profiling the potential "green" hotel guest: Who are they and what do they want? *Journal of Hospitality and Tourism Research, 38*, 361-387.

Barber conducted an email survey of 563 American hotel guests in an attempt to understand what drives consumer preference, particularly in green lodging. Guests were categorized into "shades of green" or clusters of participants with similar responses. Barber found that guests who were considered to be the most green were most concerned with price savings and improved environmental quality as benefits of going green.

Dalton, G.J., Lockington, D.A. & Baldock, T.E. (2008). A survey of tourist attitudes to renewable energy supply in Australian hotel accommodation. *Renewable Energy, 33*, 2174-2185.

This study focused on guests' and hotel operators' attitudes toward renewable energy sources (RES) in hotels. Through interviews and surveys, the authors determined if there was support for RES, guests' willingness to pay for RES, and if guests would be willing to change their own behavior to be more sustainable. Contrary to other studies, the researchers found that guest tolerance was much higher than managers originally thought and there was an overall desire for RES in hotels.

Explore Minnesota Tourism (2008). *Minnesota Travel Green Task Force: Report and Recommendations*. Saint Paul, MN: State of Minnesota.

Explore Minnesota's report featured the findings of a series of surveys about hotel energy efficiency. The study focused on customer interest in green travel and explored the potential of a "green hotels" certification program. The study found that, while customers were interested in a certification program, it would not be viable, given high time and financial costs associated with the certification process. Instead, awareness of hotels using green practices would be more beneficial.

Gunderson, M., Heide, M., & Olsson, U. (1996). Hotel guest satisfaction among business travelers: What are the important factors? *Cornell Hotel and Restaurant Administration Quarterly, 37* (2), 72-81.

The authors surveyed business travelers in three areas (reception, food and beverage, and housekeeping) to determine which factors are most important to a positive stay. By evaluating 22 different items and testing correlations, they were able to determine that interactions with the front desk and the availability of their room at check-in were the most important. Tangible factors such as room amenities and a broad survey category "general comfort" were less important to guests.

Han, H., Hsu, L., Li, J., & Sheu, C. (2011). Are lodging customers ready to go green? An examination of attitudes, demographics, and eco-friendly intentions. *International Journal of Hospitality Management, 30*, 345-355.

The researchers attempted to determine what caused consumers to choose green hotels and what types of customers were more likely to stay at these hotels. Through an online survey, the researchers found that the importance of being environmentally friendly and corporate responsibility were the most important factors in influencing hotel choice. Gender was the only statistically significant demographic factor in shifting the likeliness of choosing a green hotel, with women being more likely than men.

Kasim, A. (2004). socio environmentally responsible hotel business: Do tourists to Penang island, Malaysia care? *Journal of Hospitality and Leisure Marketing, 11* (4), 5-28.

Based on the growing interest in green hotel operations, Kasim studied the preferences of guests for green hotel attributes in Malaysia. The survey revealed that, while guests were aware of environmentally friendly attributes, few were willing to pay more or to switch hotels for these attributes. In other words, green attributes did not aid guests' decision making process.

Millar, M., & Baloglu, S. (2011). Hotel guests' preferences for green guest room attributes. *Cornell Hospitality Quarterly, 52* (3), 302-311.

Millar and Baloglu surveyed 571 travelers in an attempt to determine which sustainable features are the most attractive to hotel guests. The authors used conjoint analysis to determine the effects of these factors individually and in pairs. They tested seven attributes and found that green certification, towel or linen reuse programs, and energy efficient light bulbs were the most important to guests.

Ogbeide, G. (2012). Perception of green hotels in the 21st century. *Journal of Tourism Insights, 3* (1), Article 1.

Ogbeide examined what a 21st century tourist expects from a green hotel. Relying on 241 surveys collected in Arkansas and Texas, the author determined the importance of "green" as a concept for travelers, as well as what types of practices guests were "more prone to endure" (p. 3). Among water and energy conservation, waste reduction and "general" green practices, energy conservation was most important to guests, with 89.6 percent responding that it was "somewhat important to very important" (p. 4).

Segarra-Ona, M., Peiro-Signes, A., Verma, R., Mondejar-Jimenez, J., & Vargas-Vargas, M. (2014). Environmental management certification (ISO 14001): Effects on hotel guest reviews. *Cornell Hospitality Report, 14* (8), 4-19.

Using data from hotel websites and bookings.com, the authors examined the effects of green certification (ISO 14001) on guest comfort in Spanish hotels. They found guests tended to give higher scores on satisfaction surveys, a proxy for during-stay comfort, if the hotel was ISO 14001 certified. Of the six items tested, certified hotels scored significantly higher on housekeeping, comfort, location, and services than those not certified.

Susskind, A., & Verma, R. (2011) Hotel guests' reactions to guest room sustainability initiatives. *Cornell Hospitality Report, 11* (6), 4-13.

This study assessed whether or not guests preferred energy saving measures in hotel rooms in the Statler Hotel at Cornell University. Neither overall satisfaction with television quality nor satisfaction with television picture quality differed by energy setting. Additionally, bathroom lighting conditions did not make any significant difference in satisfaction with bathroom lighting.

Tierney, P., Hunt, M., & Latkova, P. (2011). Do travelers support green practices and sustainable development? *Journal of Tourism Insights, 2* (2), Article 5.

The authors used an online survey to monitor hotel managers' attitudes towards green practices in the U.S. and the Caribbean. With responses to a series of 18 agree/disagree statements, the researchers found that both guests and hotel operators regarded going green as increasingly important. In fact, 93 percent of respondents felt that becoming greener was imperative for the resort industry.

Research Methodology

Atkinson, A. (1988). Answering the eternal question: What does the customer want? *Cornell Hotel and Restaurant Administration Quarterly, 29* (2), 12-14.

Atkinson's article discussed survey design for hotels, particularly a survey that was conducted for the Days Inn chain. The researcher identified items of major concern to guests and created a ranking system for the importance of these factors. The researchers also discussed engaging respondents and emphasized the importance of incentives for participation.

Lewis, R., & Pizam, A. (1981). Guest surveys: A missed opportunity. *Cornell Hotel and Restaurant Administration Quarterly, 22*, 37-44.

This paper addressed common problems with guest satisfaction surveys. The researchers argued that creating a space for comments, using a wide scale, and weighting factors are the most important to obtain meaningful data. By weighting factors, hotel operators would see not only factors that need to be improved but also how important those improvements are to guests.

Schall, M. (2003). Best practices in the assessment of hotel guest attitudes. *Cornell Hotel and Restaurant Administration Quarterly, 44* (2), 51-65.

Schall provided an in-depth review of different survey methods and styles for the hospitality industry. He also identified the most effective way to gather good data from guests, including how to appropriately write questions and answer options. Furthermore, the researcher discussed the importance of having response options of "neutral" and "not applicable" in order to obtain more accurate responses.

APPENDIX B: HOTEL GUEST COMFORT QUESTIONNAIRE

Hotel Guest Comfort Questionnaire

Michaels Energy & the University of Minnesota Tourism Center

Please take a few moments to answer the following questions about how comfortable your room was. Your feedback will be helpful in improving your future stay. Thank you!

The lighting in the room was...

Too dim			Nicely lit			Too bright	
1	2	3	4	5	6	7	N/A

The air in the room was...

Too dry			About right			Too damp	
1	2	3	4	5	6	7	N/A

Did you adjust the thermostat in your room?

☐ No

☐ Yes, to what temperature: _____˚F

Control of temperature in the room was...

Very difficult			Neutral			Very easy	
1	2	3	4	5	6	7	N/A

The temperature in the room was...

Not consistent at all						Very consistent	
1	2	3	4	5	6	7	N/A

The noise level of the heating and cooling unit in the room was...

Very loud			Neutral			Very quiet	
1	2	3	4	5	6	7	N/A

The ambient noise level in the room was...

Very loud			Neutral			Very quiet	
1	2	3	4	5	6	7	N/A

The bed was...

Very uncomfortable			Neutral			Very comfortable	
1	2	3	4	5	6	7	N/A

The sheet was...

Very stiff			Neutral			Very soft	
1	2	3	4	5	6	7	N/A

The water pressure was...

Very unsatisfactory			Neutral			Very satisfactory	
1	2	3	4	5	6	7	N/A

The water temperature was...

Very unsatisfactory			Neutral			Very satisfactory	
1	2	3	4	5	6	7	N/A

The towels in the bathroom were...

Very stiff			Neutral			Very soft	
1	2	3	4	5	6	7	N/A

In general, the room was...

Very dirty			Neutral			Very clean	
1	2	3	4	5	6	7	N/A

The overall experience in the room was...

Very uncomfortable			Neutral			Very comfortable	
1	2	3	4	5	6	7	N/A

Would you stay at this hotel again?

☐ Yes ☐ No ☐ Prefer not to answer

What are the most important qualities that you consider when choosing a hotel? (Please select all that apply)

☐ Cost ☐ Location ☐ Room comfort ☐ Guest reviews
☐ Hotel amenities ☐ Hotel brand ☐ Availability of special packages ☐ Previous experiences

What hotel amenities are most important to making your stay comfortable? (Please select all that apply)

☐ Cleanliness ☐ Quietness ☐ Room temperature ☐ Friendly staff
☐ Room lighting ☐ Bed comfort ☐ Bathroom amenities ☐ Hotel common areas

Other Comments?

_____

_____

_____

Finally, a few questions about you.

Have you stayed at this hotel before?
☐ No
☐ Yes, please indicate the number of times:
☐ 1-3 ☐ 4-6 ☐ 7-10 ☐ More than 10 times

Please indicate the purpose of your trip:
☐ Business ☐ Leisure ☐ Business and leisure ☐ Other

Room Number: _____

Have you ever complained to a hotel because a room was uncomfortable?
☐ Yes ☐ No ☐ Prefer not to answer

If you knew that a hotel was certified as energy efficient, would you be more likely to choose this hotel, assuming other criteria (e.g., cost, location) were comparable?
☐ Yes ☐ No ☐ Prefer not to answer

_____

For administrative purposes only: WEEKDAY WEEKEND (Friday 1pm-Sun)
Date: _____/_____ Time: _____ am/pm
Location: _____

APPENDIX C: QUALITATIVE COMMENTS FROM HOTEL GUEST QUESTIONNAIRE

Guests were invited to write any additional comments about their stay at the end of the questionnaire. Of the 125 survey participants, 43 wrote additional comments. The following comments are quoted directly from the guest surveys.

Comments

- Have been pleased with this hotel- everything has been great. Free good breakfasts!
- Wifi is an important amenity
- This hotel needs a lamp on the table for working. Some hotels do not have lights near reading chairs. We brought our own pillows. The thermostat should be digital-- easier to control. Like hotels where breakfast is included.
- Workout/Pool is important. Set Thermostat lower.
- New carpet smell
- Turned air on low
- My door was broken- wouldn't latch shut. Dirty common areas and elevator.
- Staff is great, room is clean, and I found the breakfast to be good and well maintained.
- Wifi is an important amenity
- Not much one can do about 3am + 4am freight train horns… sigh
- Upgraded cooling and heating units should include a humidifier. Use of commercial laundry services tends to produce sheets and pillowcases with a nasty odor.
- Wish there were grab bars in bathroom by the tub and toilet
- Turned thermostat down. Water handles were too stiff to operate reasonably. The room layout was nice. Loved the stairs and the general layout and décor of the common area. Connection to restaurant neat.
- Breakfast was great
- I like a good gym too
- Piece of debris under bathroom counter when we came in. Energy efficiency is important- I hate the wasteful a/c units in rooms but….
- Turned thermostat down. Ice bucket lid was sticky, complained at this hotel because the original room was too close to the elevator.
- Pet friendly
- Free breakfast and wifi are important
- One of the lamps didn't work. The shower head was quiet but they should change to new air conditioning units.
- Enjoyed stay! Would stay again
- The hotel is nice and clean
- Nice place to stay
- I travel 40percent of my time for work, plus my daughter spends a lot of time traveling for softball. I really like this hotel. Very nicely upgraded.
- Great experience here. Great service and very clean room.
- The control of the temperature was easy once we found the unit and the noise level was good.
- Turned off a/c unit. Hilton Garden Inn is my favorite- Embassy Suites 2nd place.
- Use of hotel shuttle very very good (from this visit and last visit)
- Good gym.
- I wish there were a few different types of pillows on the bed so guests have a selection and can choose one similar to one they use at home instead of only having large fluffy pillows (as you can tell, I prefer a flatter pillow)
- Shuttle, pool and exercise room

- Fitness room equipment
- Hot tub/pool
- very good stay
- Sink and tub in room (128) drained very slow
- The temperature was set at 70. Control of the thermostat was easy in one room of the two room suite.
- The cleanliness of the carpet impacts my overall impression of the room. I turned the air conditioner off.
- exercise room
- Non-smoking facility important. Many chains use carpet chemicals that can trigger asthma attacks. Holiday Inn Express is one chain that consistently does not use these- so it it is "safe" for asthmatics. Others are "hit and miss"- Hampton, Best Western etc. Mold control also an issue for asthmatics.
- Free breakfast rather than over-priced (and overly big) high-end hotels. Really like hotels that have window air that creates strong "white noise" that helps sleep and privacy.
- Turned off the AC because it was loud. The carpet wasn't so clean. People were stomping in the room above.
- Noise level was worse the second night since the hotel was busier.
- Easy early check-in